

CLAIMS

What is claimed is:

1. A device for immobilizing two structures, said device comprising:
a first anchor for becoming secured with respect to a first structure; and
a brace having a distal end pivotally mated with a proximal end of said first anchor.
2. The device of claim 1 wherein said distal end of said brace is adapted for transferring torque and compressive force from said brace to said first anchor.
3. The device of claim 1 wherein said brace comprises:
a proximal end, said proximal end adapted for locking with a mating receptacle attached to the proximal end of a second anchor secured in a second structure spaced apart from said first structure, said locking occurring when said distal end of said brace pivots with respect to said proximal end of said first anchor, said pivoting occurring while said distal end of said brace remains pivotally mated with said proximal end of said first anchor.
4. The device of claim 3 wherein said receptacle allows for polyaxial rotation with respect to said second anchor.
5. The device of claim 3 wherein said receptacle is a force fit with respect to said proximal end of said brace.
6. The device of claim 3 wherein said receptacle provides positive feedback when said proximal end of said brace is properly mated with said receptacle.
7. The device of claim 1 further comprising:
a hinge attached to a proximal end of said first anchor for facilitating said pivotal mating.
8. The device of claim 7 wherein said hinge allows for polyaxial rotation with respect to said first anchor.
9. The device of claim 1 wherein said proximal end of said brace is further adapted to accept torque applied thereto.

10. The device of claim 1 wherein said structures are vertebrae and wherein said anchors are screws for placement in the pedicle of said vertebrae.

11. A system for spinal vertebrae immobilization comprising:

a first cannula;

a first pedicle screw for implantation in a first vertebra; said implantation occurring by connecting said first pedicle screw to a distal end of said first cannula;

a brace having a first end for pivotally mating with a proximal end of said first pedicle screw while said brace is attached to a said proximal end of said first pedicle screw, said brace positioned within said first cannula, the proximal end of said brace positioned within said first cannula beneath the skin line of a patient after said first pedicle screw is implanted in said first vertebra; and

said first cannula having at least one opening therein for allowing a mated brace to pivot with respect to said first pedicle screw.

12. The system of claim 11 further comprising:

a first mating structure at the distal end of said brace; and

a second mating structure at said proximal end of said first pedicle screw, wherein said first and second mating structures are adapted for power transfer.

13. The system of claim 12 wherein said first pedicle screw is implanted by said power transfer.

14. The system of claim 13 wherein said power transfer is torque transfer.

15. The system of claim 11 further comprising:

a second cannula;

a second pedicle screw for implantation in a second vertebra;

a receptacle attached to a proximal end of said second pedicle screw, said receptacle positioned within said second cannula when said second pedicle screw is implanted in said second vertebra; and

said second cannula having at least one opening therein for allowing said proximal end of said brace to enter said second cannula and mate with said receptacle when said brace pivots with respect to said first pedicle screw.

16. The system of claim 15 wherein said last-mentioned mating causes a distinctive sensory event when said proximal end of said brace is properly positioned with respect to said receptacle.

17. The system of claim 15 wherein said opening in said first and second cannulas allow said cannulas to be removed from said patient after said brace is mated with said receptacle.

18. The system of claim 15 wherein said receptacle is polyaxial with respect to said second pedicle.

19. The system of claim 15 wherein said brace accepts locking devices at each end thereof after said brace is mated to said receptacle, said locking devices preventing further movement of said brace with respect to said screws.

20. A hinge for use with a bone anchor support system, said hinge comprising:
proximal and distal openings in-line from each other forming an in-line passage through said hinge;

said proximal opening comprising a clamp for rotatable attachment to the head of a bone anchor;

said proximal opening adapted to accept the distal end of a brace, said hinge further comprising a pivot point for capturing an accepted brace so as to allow said accepted brace to pivot with respect to said hinge but not to become released therefrom; and wherein said clamp allows said distal end of an accepted brace to become detachable coupled to said head of an attached anchor for the purpose of force transfer between said brace and said anchor.

21. The hinge of claim 20 wherein the proximal end of said hinge is further adapted to accept a force applying locking structure.

22. The hinge of claim 20 wherein said pivot includes at least one pair of bearings positioned on either side of said in-line passage.

23. A brace for use with a bone anchor support system, said brace comprising:
a curved shank portion slightly longer than the distance between the bones to be supported; said shank comprising:

a first key at its distal end for releasably mating with a head of a first anchor so as to allow torque transfer between said brace and said first anchor; and

a second key at its proximal end for releasably mating with a receptacle at a second one of said anchors.

24. The brace of claim 23 wherein said shank further comprises:

at least one slot longitudinally displaced along said shank in proximity to said distal end, said slot for accepting a fulcrum point affixed to said first anchor so as to allow said brace to pivot around said fulcrum point while still maintaining said shank in controlled spatial relationship with said first anchor.

25. A device for stabilizing first and second bones, said device comprising:

a first bone anchor having an attachment;

means for capturing a brace within said attachment; and

means for supporting a captured brace such that said captured brace can either be in-line with said anchor or positioned to form an angle with said anchor.

26. The device of claim 25 wherein said supporting means comprises:

a pair of bearings displaced on opposite sides of said captured brace, said bearings interfacing with said brace by indentations longitudinally displaced along said brace.

27. The device of claim 26 wherein said brace has a distal end adapted for transmitting force between said brace and said first bone anchor while said brace is in-line with said first bone anchor.

28. The device of claim 27 wherein said transmitted force is torque.

29. The device of claim 26 wherein said brace comprises:

means for engaging a receptacle attached to a second bone anchor spaced apart from said first bone anchor, said device further comprising;

means for polyaxially attaching said receptacle to the head of said second bone anchor; and wherein said receptacle comprises means for engaging with said brace.

30. The device of claim 29 wherein said first and second anchor engagement means comprise:

means for locking said brace and said anchors in a fixed relationship with each other.

31. The method of stabilizing bones, said method comprising:

attaching to a first cannula a first bone anchor having affixed to its proximal end a hinge, said hinge having captured therein the distal end of a bridging rod, said bridging rod engaged with said first bone anchor and extending within said first cannula;

positioning said first cannula in alignment with a first bone location into which said first bone anchor is to be placed; and

applying force through said first cannula to the proximal end of said bridging rod so as to attach said first bone anchor to said first bone at said first bone location.

32. The method of claim 31 further comprising:

attaching to a second cannula a second bone anchor having affixed to its proximal end a receptacle, said receptacle adapted for receiving the proximal end of said bridging rod;

applying force through said second cannula to the proximal end of said second bone anchor so as to attach said second bone anchor to a second bone at a second bone location; and

pivoting said bridging rod at its distal end within said first cannula, wherein said pivoting causes inserting of said proximal end of said bridging rod into said second cannula, said second cannula guiding said proximal end to said receptacle.

33. The method of claim 31 further comprising:

attaching to a second cannula a second bone anchor having affixed to its proximal end a receptacle, said receptacle adapted for receiving the proximal end of said bridging rod;

applying force through said second cannula to the proximal end of said second bone anchor so as to attach said second bone anchor to a second bone at a second bone location;

disengaging said distal end of said bridging rod from said proximal end of said first bone anchor; and

urging said proximal end of said bridging rod out of said first cannula through an opening in a side wall of said first cannula, said urging in a direction toward said second cannula, while said distal end of said bridging rod remains captured by said hinge affixed to said first bone anchor.

34. The method of claim 33 further comprising:
continuing to urge said proximal end of said bridging rod toward said second cannula until said proximal end of said bridging rod enters said second cannula through an opening in a side wall of said second cannula; and
continuing to urge said bridging rod until said proximal end of said bridging rod engages said receptacle.
35. The method of claim 34 wherein said engaging is signaled by sensory feedback.
36. The method of claim 35 wherein said feed back is tactile.
37. The method of claim 34 further comprising:
positioning a first set screw down said first cannula to engage said distal end of said bridging rod; positioning a second set screw down said second cannula to engage said proximal end of said bridging rod; and
tightening said set screws so as to lock said brace, said hinge, said receptacle and said anchors with respect to each other.
38. The method of claim 37 further comprising:
removing said first and second cannulas.
39. The method of claim 38 where said first and second cannulas are positioned through dilators inserted through a common incision in the skin of a patient.
40. The method of claim 39 further comprising:
prior to said disengaging and said urging, removing from said common incision said dilators thereby exposing said first and second cannulas.
41. The method of claim 40 further comprising:
after said first and second cannulas are removed, repairing said common incision.
42. The method of claim 37 wherein at least one of said hinge and said receptacle is polyaxial.